Iranian Journal of Educational Sociology

(Interdisciplinary Journal of Education)
Available online at: http://www.iase-idje.ir/
Volume 6, Number 2, June 2023

Identifying the Dimensions and Components of Education based on Flipped Learning in Elementary School

Zohreh Soltan Mohammadi[1], Leila Sharifian[2*], Saeid Moradi[3], Alireza Araghieh[4]

1. PhD student, Department of Educational Management, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran
2. Assistant Professor, Department of Educational Sciences, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran
3. Assistant Professor, Department of Educational Sciences, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran
4. Professor, Department of Educational Sciences, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran

Article history:
Received date: 2023/03/02
Review date: 2023/05/21
Accepted date: 2023/05/31

Keywords:
Education, Flipped Learning, Teaching and Learning Process, Elementary School

Purpose: Students' learning style is one of the important factors that help teachers to prepare conditions for students' learning. So, the aim of this research was to identify the dimensions and components of education based on flipped learning in elementary school.

Methodology: This study was applied in terms of purpose and descriptive in terms of qualitative type. The research community were experts in the fields of elementary education, curriculum planning and educational management. Sampling was done with targeted and snowball sampling methods and continued until the research reached theoretical saturation, i.e. 19 people. The research tool was a semi-structured interview with experts, whose validity was confirmed by the triangulation method, and its reliability was calculated by the method of the agreement coefficient between two coders of 0.88, and the data analysis was done by thematic analysis method in MAXQDA-12 software.

Findings: The findings indicated that education based on flipped learning in elementary school has 45 indicators, 9 components and 3 dimensions of input (with 3 components of equipment, learner and teacher), teaching and learning process (with 3 components of learner preparation, teacher preparation) , learning activities and interaction) and output (with 2 components of implicit results and objective results). Finally, according to the identified dimensions and components, a teaching model based on flipped learning was designed in the elementary school.

Conclusion: The results of this study indicated that in order to improve education based on flipped learning, the dimensions and components identified for it should be given special attention and the ground for their improvement and promotion should be provided.

Please cite this article as: Soltan Mohammadi Z, Sharifian L, Moradi S, Araghieh A. (2023). Identifying the dimensions and components of education based on flipped learning in elementary school, **Iranian Journal of Educational Sociology.** 6(2): 45-53.

* Corresponding Author: la_sharifian@yahoo.com

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

1. Introduction

Education is a complex process that any simplistic approach can lead to waste of resources and resources and make any effort fail. Therefore, the development of education and the creation of transformation in it requires knowledge of the education process and awareness of new methods of its implementation. This issue is more important in education. Because the mission of education, especially in the primary period, is to train capable and competent students who have the necessary knowledge, attitude and skills to maintain and improve the society (Yaghoubi and Vaghef, 2020). The expansion of education and the flourishing of talents requires knowledge of the education process and knowledge of new teaching methods, learning styles, knowledge of the learner and knowledge of the teacher, and finally knowledge of structural needs (Tafarojei and Yousefi, 2021)

Teaching methods mean methods that facilitate the ability to use a large amount of information and apply it in all areas of life. In recent years, the view is supported that the knowledge created by students and teachers is useful and can be transferred to other learning situations. People use different learning styles to learn according to their individual differences, teachers should consider the learning needs of students in the teaching process (Scott, Rodriguez, Soria and Campo, 2014). Since teaching and learning play a major role in the development of students' skills, teachers and students of these fields must learn how to act as professionals in the educational environment (Tan, Liang and Tsai, 2021). The more teachers and students understand about teaching and learning, the more targeted and consistent their actions become. Most experts are of the opinion that education based on flipped learning should be done with a different approach compared to other educations. Because the development of knowledge in this way differs from the content that teachers taught based on traditional methods and affects their teaching experiences (Ahmadi, 2022).

In addition, teachers differ in different societies and cultures, and thus, teachers' teaching methods are influenced by other social and cultural patterns and behaviors. Also, a part of education based on flipped learning takes place in virtual environments, and the virtual activity of students makes the process of teaching students more complicated, because both the teacher and the student must be careful, not to cause interference in education. (Jaladati, Bahrami, Hojatansari and Shoshtarirezvani, 2021).

In any educational event, the most important element is the style by which the instructor communicates his or her individual beliefs to the learners (Atashi, Minaian, Gharibpour and Irajpour, 2021). In addition, the importance of teaching and learning exchange model to other constituent elements, including students, is influenced by teachers' beliefs and approaches. In other words, teachers' teaching style has a decisive role in the teaching process. Therefore, by studying teaching styles, we can become aware of the teaching's beliefs, values and behaviors in the teaching and learning exchange model (Pourghafar and Jafarzadeh Dashbalagh, 2021). In the learning and teaching exchange model, students' learning style is very important (Johnny, Michael and Rahimi, 2020). Since students have different learning styles that affect their learning and academic achievement, it is necessary for teachers to be aware of how and what types they are to help students make optimal use of different learning styles (Haji, Mohammadi Mehr and Mohammadi Azar, 2021). Accordingly, adaptation or differentiation of teaching styles with learning styles is of particular importance, because not every teaching necessarily ends in learning, so it is necessary to identify the facilitating and inhibiting factors of learning (Tan et al, 2021).

The factors affecting learning and academic achievement are very broad and identifying these factors is important in solving problems and failures in the educational system. One of the factors that leads to academic achievement and increase educational efficiency is the intrinsic motivation in people to learn. Therefore, paying attention to individual differences and identifying their learning styles and providing an educational program tailored to the characteristics of learners can make them learn better and feel satisfied with learning. Flipped learning style can be defined as the way people process fresh information and experiences in their minds (Chatziralli, Ventura, Touhami, Reynolds, Nassisi, Weinberg et al., 2021). Flipped learning styles can be considered as one of the most important constructs of educational psychology. Flipped learning styles refer to the ways in which people develop concepts, rules, and

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

principles that guide them in dealing with new situations. Flipped learning styles are defined as the individual's stability in perception, memory, thinking, and judgment in the same conditions (Gonzalez-Calvo, Barba-Martin, Bores-Garcia and Hortiguela-Alcala, 2021). Flipped learning styles for students have a wide range of applications in education, including classification of learning priorities, to understand its inadequacies in the early stages and to select appropriate teaching methods (Kaini and Motie, 2021).

The results of Sointu, Hyypia, Lambert, Hirsto, Saarelainen and Valtonen (2023) indicated that key factors of success in reversal classroom of students included three educational dimensions (with five components of students' viewpoint to teachers' content knowledge, educational perceptions about perceived purposeful teaching, constructive feedback, level of difficulty experienced in the flipped classroom and guidance for the classroom as a study method), social (with three components of collaborative work, supporting other students and a safe space for learning) and technology (with two components of students' readiness to use ICT for study and the added value of ICT in education). Study by Ehteshami, Golzari and Fathi Vernosfadrani (2022) showed that the professional development of faculty members with a flipped learning approach has 55 sub-components in 15 main components including institutional factors, support and pedagogy, evaluation and quality assurance, learning format, professional ethics, educational, research, organizational, service developments, technical, perceptive, and leadership skills, organizational development and cultural factors. The research of Alipour and Ghasemi (2022) indicated that the educational and behavioral consequences of flipped learning include two dimensions of participation in the classroom for learning (with components of social consequences, individual and personal consequences, environmental and time consequences, and communication consequences and interpersonal relationships) and education. It was outside the classroom (with components of individual and personal consequences and environmental and time consequences). Also to explain the flipped learning process in education, Ali-Ismaeili, Hosseini Darounkolaei and Goran Orini (2021) in a study showed that this structure has 12 dimensions of learning motivation, individual, organizational culture factors, structural factors, implementation of flipped learning, facilitating measures, barriers and organizational challenges, non-organizational obstacles and challenges, laying the foundations and planning, awareness raising, quality of education and learning. Koh (2019) introduced four educational dimensions for a better understanding of flipped classroom practices including personalization, higher order thinking, self-directed collaboration. Kaviani, Liaghatdar, Zamani and Abedini (2018) reported that flipped classroom learning outcomes in teaching and learning activities included 119 learning outcomes in 7 dimensions: time, interaction, skill, individual, group, academic and teaching.

Flipped learning is an innovative and learner-centered approach that has become very popular with teachers and educational professionals recently. This method is a method based on constructivism theory in which learners are active and active learning is strengthened in them (Alipour and Ghasemi, 2022). According to the activeness of the flipped learning method, this method can improve students' motivation to strengthen and deepen learning. Therefore, first it is necessary to identify its dimensions and components, then provide programs to improve and strengthen them. One of the existing gaps was the lack of research on the dimensions and components of flipped learning, and since this method can provide additional motivation for primary school students to learn, the researchers sought to design a model of flipped learning in the primary school. In addition, students' learning style is one of the important factors that help teachers to prepare the conditions for students' learning. As a result, the aim of this research was to identify the dimensions and components of education based on flipped learning in elementary school.

2. Methodology

This study was applied in terms of purpose and descriptive in terms of method of implementation. The research population was experts in the areas of primary education, curriculum planning and educational management. Sampling was carried out by targeted sampling and snowball sampling methods and continued

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

until the research reached theoretical saturation (i.e. 19 people). In targeted sampling, the samples were selected according to the criteria in this study, the most important criteria included at least 3 years of work experience, having an article or dissertation guidance and dissertation in the field of research. Out of 19 experts participating in the study, 5 (26.32%) were faculty members and the rest, i.e. 14, were not 73.68% of the faculty members.

The research tool was semi-structured interviews with experts whose questions were designed with the help of supervisors and consultants. For interviewing experts, first necessary coordination was made with them for location, time and conditions of the interview, and their agreement was obtained to participate in the research. Interviews were conducted individually and question-by-question, so that after completing the answer to the first question, the second question was asked and this process continued until the questions were completed. The validity of the findings of semi-structured interviews with experts was confirmed by triangulation method and its reliability was calculated 0.88 by the coefficient of agreement between the two coders.

To accomplish the study, design interview questions, samples were identified and the importance and necessity of the research was explained. In addition, individual interviews were done, and the accuracy of the findings were confirmed by experts, and then they were appreciated and thanked for participating in the research and finally the data were analyzed. It should be noted that data analysis of semi-structured interviews with experts was performed by thematic analysis method in MAXQDA-12 software.

3. Findings

Thematic analysis method was used to analyze the data obtained from 19 interviews. Therefore, the results of the analysis of the themes of dimensions, components, extractive concepts, indicators and codes of interviewees based on inverse learning were reported in Table 1.

Table 1. Results of Dimension Theme, Components, Extractive Concepts, Indices and Codes of Interviewees based on Flipped Learning in Elementary School

Dimensions	Parameters	Extractive Concepts	Indicators	Interviewees Code
Input	Equipment	Applying educational technologies related to primary school plays an important role in teaching based on flipped learning.	Applying Educational Technology	I12, I5, I14, I2, I11
		Providing online and offline education is very important for all students.	Online and Offline Training	I3.I11و I10
		Designing the educational content of elementary courses that corresponds to the goals of teaching in flipped learning.	Designing the educational content of elementary courses	I3, I4, I11, I5
		The most important factor in the success of students and teachers in teaching through flipped learning is the support of electronic equipment and educational processes (online and offline).	Equipment Support	I12, I8, I3
	Learner	Motivating students to learn is very important.	Motivation	I5, I12, I8, I3
		Shaping students' beliefs and attitudes towards learning is crucial.	Attitude	I 1I10, I6, I5,
		Teaching learning styles to students indirectly is very important.	Learning Style	I14, I15
		Students' individual and personality characteristics are effective in their participation and learning.	Personality Trait	I4, I14, I15
		The pre-organizers and previous knowledge	Previous knowledge	I3, I4, I11,

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

		of students are influential in their secondary learning.		
		Familiarity of students with new technologies is of particular importance.	Technology Readiness	I16, I 18
	Teacher	Teachers' attitude toward flipped learning is of particular importance.	Attitude	I5, I12, I8, I3
		Teaching methods and teaching style of teachers are good determinants for students' participation in the learning process.	Teaching Style	I16
		Giving motivation to teachers by itself is of utmost importance and becomes an important motivating factor in them.	Motivation	I3, I4, I11, I5
		Teachers' readiness and skills are very important in using technology.	Technology Readiness	I14, I2, I11
		Electives for teaching by teachers are very important in the success rate of flipped learning-based teaching.	Selected Content	I3, I4, I11, I5
Teaching and learning process	Learner Readiness	In order to teach in flipped learning, students should be prepared for their previous knowledge.	Determining the level of prior knowledge	I12, I19, I14, I2, I11
		For teaching based on flipped learning, people's assumptions and imaginations are very important and must be aligned with others in order for the teacher to achieve the same results.	Visions	I3, I14, I11, I5
		During training, the teacher must clearly state his expectations of the students.	Expressing expectation from the learner.	I12, I8, I3
		Training the culture of using educational tools and how to teach and interact with others are effective in education.	Culture of how to Learn	I3, I4, I17, I5
		Preparing students for self-assessment during learning is essential.	self-assessment	I12, I5, I14, I19, I11
	Preparation for teacher	First, teachers should design instructional syllabus for the specified courses.	Curriculum Design	I3, I4, I16, I5
		Teachers should have sufficient knowledge of how to manage the classroom and interactions with students and students together before entering the training arena.	Classroom Management and Interaction Training	I12, I5, I19, I2, I11
		Teaching teachers about the necessary technologies during learning is essential	Training Necessary Technology	I3, I4, I11 و I10
		Understanding the flipped learning processes is important.	Introduction to flipped learning processes	I12, I5, I14, I2, I11
	Learning and interaction activities	Using the speech method is important for conveying information.	Speech Method	I12, I5, I14, I19, I11
		The use of group and collaborative learning is essential.	Group and collaborative learning	I 1I10, I6, I5,
		The use of group activities is effective.	Group Activities	I14, I15
		The use of problem solving is essential.	Problem Solving	I4, I14, I15
		Using group discussion is essential.	Group discussion	I3, I4, I11,
		In teaching, independent individual learning	Independent	I16, I 18

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

		is important to use.	Individual Learning	
		Searching is essential in the fields of study.	searching	I5, I12, I19, I3
		The ability to analyze data is important for understanding content.	Analysis	I16
		The ability to combine information is essential in learning.	combination	I3, I4, I11, I5
		External evaluation of information plays an important role in learning.	External evaluation	I14, I2, I11
	Interaction	Sometimes there are interactions between two learners.	Learner-Learner	I3, I4, I11, I15
		Sometimes interactions between the learner and the support occur.	Learner - Supporter	I12, I15, I14, I18, I11
		Sometimes there are interactions between the learner and the learner.	Learner – Teacher	I13.I12و I10
		Sometimes interactions between the learner and the content happen.	Learner - Content	I3, I4, I11, I15
		Sometimes interactions between the teacher and the content happen.	Learner - Content	I12, I8, I14
		Sometimes there are interactions between the teacher and the supporter.	Teacher- supporter	I12, I5, I14, I12, I13
Output	Implicit results	One of the objective outcomes in flipped learning is the development of thinking skills in students.	Developing thinking skills	I3, I4, I11, I5
		One of the objective outcomes in flipped learning is positive attitude and satisfaction of teaching and learning in students and teachers.	Positive attitude and satisfaction	I12, I5, I14, I2, I11
		One of the objective outcomes in flipped learning is the improvement of communication skills between teachers and students and students together.	Improving communication skills	I3, I4, I11, I5
	Objective outcomes	One of the objective outcomes in is the flipped learning is students' academic achievement.	Academic Achievement	I3, I19, I11, I5
		One of the objective outcomes in flipped learning is the ability to manage time by students and teachers.	Ability to manage time	I12, I19, I3

According to the results of Table 1, instruction of flipped learning based in the primary period had 45 indicators, 9 components and 3 dimensions of input (with 3 components: equipment, learner and teacher), teaching and learning process (with 3 components of learner readiness, teaching readiness, learning activities and interaction) and output (with 2 components, implicit and objective results). Considering the dimensions and components identified above, the flipped learning-based instruction pattern in the elementary period was reported in Figure 1.

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

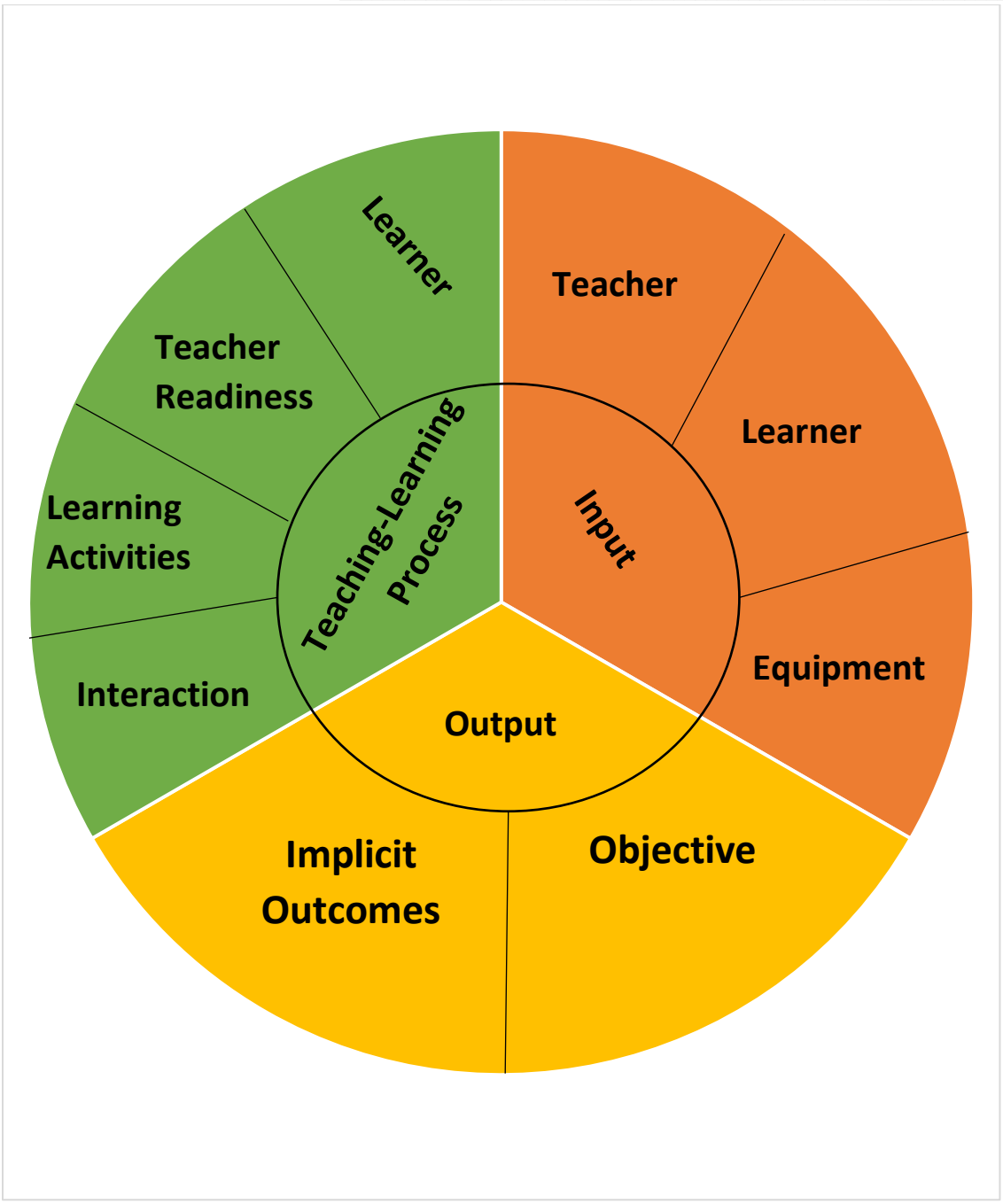

Figure 1. The flipped Learning Based Education Model in Elementary School

In Figure 1, the flipped learning-based education model in elementary period is observed based on the identified dimensions and components of interviews with experts.

4. Discussion

Education is on the verge of a revolution due to the power of technology, information, communication, learning methods and styles; the schools of the present age, especially the elementary courses, are facing a major transformation. Lack of budget, increasing student numbers, changing student populations, modern and new educational needs of society require organizational change. Changes that meet new needs.

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

Therefore, the aim of this study was to identify the dimensions and components of flipped learning-based education in elementary school.

The findings showed that flipped learning-based education in the primary period had 45 indicators, 9 components and 3 dimensions of input (with 3 components: equipment, learner and teacher), teaching and learning process (with 3 components of learner readiness, teaching readiness, learning activities and interaction) and output (with 2 implicit outcomes and objective outcomes).

These findings are in some ways consistent with those of Sointu et al. (2023), Ehteshami et al (2022), Alipour and Ghasemi (2022), Ali-Ismaili et al (2021), and Kaviani et al (2018). To determine the characteristics of flipped learning, it is necessary to know the capabilities of the environment well and apply the learning theories appropriately adjusted to that environment. For this purpose, theoretical foundations of flipped learning-based education, concepts related to flipped learning-based education, theories of learning and researches related to flipped learning-based education are so many that this study was accomplished with 19 experts in this field through semi-structured interviews. Finally, three dimensions, nine components and 45 indicators were designed. The first dimension of inputs with 3 components of equipment, and learner and finally 16 indices of motivation, attitude, learning style, personality traits, previous knowledge, technology readiness, attitude, teaching style, technology readiness, selected content, information and communication technology related to innovative course, offline and online education, educational design of primary courses, equipment support and familiarity with learning processes were reverse-scored. The second dimension was the process of teaching and learning with 4 components of learner readiness, learner readiness, learning activities and interaction, for which 24 indicators were determining the level of previous knowledge, ideas, expressing expectation from learner, culture of learning instruction, self-assessment, instructional design of lessons, classroom management and interaction training, necessary technology training, group and collaborative learning, group activities, lecture, problem solving, group discussion, independent individual learning, searching, analysis, combination, external evaluation, learner-learner, learner- supporter, learner- teacher, learner- content, learner-content, teacher-support. The third dimension of output were considered with two components of objective and implicit outcomes and 5 academic achievement indicators, ability to manage time, developing thinking skills, positive attitude and satisfaction, and improving communication skills.

This study is a purely qualitative research and has all the limitations of this research method. The results of this study are the result of interviews with a number of experts in this field, and perhaps if investigated quantitatively, some indices would be omitted and some components and dimensions will be merged as well. Therefore, it is essential that the instrument made in this study be quantitatively investigated and standardized in future studies. Also, it can be used to investigate the current situation of flipped learning-based education in primary school and also based on its results, strategies can be designed and implemented to improve flipped learning-based education. The results of this study indicated that in order to improve the training based on flipped learning, the dimensions and components identified for it should be paid special attention with paving the grounds for their improvement and promotion. Therefore, the following suggestions are presented.

1. Macro policies in order to improve the level of education based on flipped learning
2. Assessment of readiness of students and teachers in primary schools for flipped learning based education
3. Preparation of appropriate content of primary course in order to flipped learning-based education
4. Providing educational facilities and equipment to improve the level of training based on flipped learning

Acknowledgments

In this research, the ethical standards including obtaining informed consent, guaranteeing privacy, confidentiality, etc. are observed, and the participants are hereby thanked.

[DOR: 20.1001.1.26453460.2023.6.2.5.2]
[DOI: 10.61186/ijes.6.2.45]

Thank you and Appreciate

Respected professors and experts are thanked for their advice and guidance and participation in the interview.

References

Ahmadi L. (2022). Analyzing teachers' concerns about virtual secondary education (A phenomenological study). New Approach in Educational Sciences. 4(1): 35-41. [Persian]

Ali-Ismaili A, Hosseini Darounkolaei SZ, Goran Orimi A. (2021). Flipped learning process in Mazandaran University of Medical Sciences: A grounded theory study. Journal of Mazandaran University of Medical Sciences. 31(199): 144-155. [Persian]

Alipour M, Ghasemi SA. (2022). Educational and behavioral consequences of flipped classroom learning: A phenomenological study. Journal of Teacher's Professional Development. 7(3): 77-93. [Persian]

Atashi M, Minaian A, Gharibpour AM, Irajpour M. (2021). Corona virus outbreak, Turn threats into opportunities in the field of information technology by turning to e-learning. Applied Research in Engineering. 4(12): 37-47. [Persian]

Chatziralli I, Ventura CV, Touhami S, Reynolds R, Nassisi M, Weinberg T, et al. (2021). Transforming ophthalmic education into virtual learning during COVID-19 pandemic: a global perspective. Eye. 35(5): 1459-1466.

Ehteshami MR, Golzari Z, Fathi Vernosfadrani L. (2021). Identifying and validating the main components of professional development courses for faculty members of Farhangian University with a flipped learning approach: Meta-composition and interview. Iranian Association of Sociology of Education. 8(2): 13-26. [Persian]

Gonzalez-Calvo G, Barba-Martin RA, Bores-Garcia D, Hortiguela-Alcala D. (2021). The (virtual) teaching of physical education in times of pandemic. European Physical Education Review. 28(1): 205-224.

Haji J, Mohammadi Mehr M, Mohammadi Azar H. (2021). Representing the problems of cyberspace education using the happy program in the Corona pandemic: A phenomenological study. Journal of Information and Communication Technology in Educational Sciences. 11(3): 153-174. [Persian]

Kaviani H, Liaghatdar MJ, Zamani BE, Abedini Y. (2018). Research synthesis of the educational outputs of the flipped classroom in teaching and learning activities. Teaching of Education Journal. 12(2): 145-166. [Persian]

Koh JHL. (2019). Four pedagogical dimensions for understanding flipped classroom practices in higher education: A systematic review. Educational Sciences: Theory & Practice. 19(4): 14-33.

Jaladati S, Bahrami M, Hojatansari Z, Shoshtarirezvani M. (2021). The relationship between job stress and pray in nursing students. New Approach in Educational Sciences. 3(1): 26-31. [Persian]

Johnny S, Michael N, Rahimi P. (2020). The effectiveness of cognitive-behavioral therapy via the Internet on reducing coronary anxiety in health care workers in Parsabad. Journal of Information and Communication Technology in Educational Sciences. 10(4): 129-145.

Kaini S, Motie LZ. (2021). Virtual vs online: Insight from medical students. Comment on effectiveness of virtual medical teaching during the COVID-19 crisis: Systematic review. Medical Education. 7(2): e27020.

Pourghfar L, Jafarzadeh Dashbalagh H. (2021). Virtual education - parent / student communication. New Achievements in Humanities Studies. 4(37): 58-64. [Persian]

Scott E, Rodriguez G, Soria A, Campo M. (2014). Are learning styles useful indicators to discover how students use Scrum for the first time? Computers in Human Behavior. 36: 56-64.

Sointu E, Hyypia M, Lambert MC, Hirsto L, Saarelainen M, Valtonen T. (2023). Preliminary evidence of key factors in successful flipping: Predicting positive student experiences in flipped classrooms. Higher Education. 85: 503-520.

Tafarojei A, Yousefi F. (2021). Relation of emotional intelligence to subjective vitality: mediating role of self-compassion. Journal of Psychological Sciences. 20(98): 283-294. [Persian]

Tan AL, Liang JC, Tsai CC. (2021). Relationship among high school students' science academic hardiness, conceptions of learning science and science learning self-efficacy in Singapore. International Journal of Science and Mathematics Education. 19(2): 313-332.

Yaghoubi H, Vaghef L. (2020). The common and unique role of maladaptive cognitive emotion regulation strategies in predicting emotional problems of nursing students. Journal of Psychological Sciences. 19(90): 715-722. [Persian]

[DOR: 20.1001.1.26453460.2023.6.2.5.2]

[DOI: 10.61186/ijes.6.2.45]